AMENDMENTS TO THE CLAIMS

Please amend the claims as indicated hereafter.

Claims:

1. (Original) A method for measuring voice quality of a communication network, comprising:

providing a reference marker that indicates onset time of a reference voice test signal, and the reference voice test signal;

receiving through the network packets containing a transmitted marker and a transmitted voice test signal through the network;

comparing the transmitted marker with the reference marker, or portions thereof, to ascertain onset time of the transmitted voice test signal in the packets received; and

processing the transmitted voice test signal and the reference voice test signal to measure quality of the network.

2. (Original) The method of claim 1, wherein the comparison of the markers includes cross-correlating the markers to obtain a score.

3. (Original) The method of claim 2, wherein the comparison of the markers includes comparing the cross-correlation score with a threshold.

4. (Original) The method of claim 3, wherein a relative timing offset between the transmitted marker and the reference marker corresponding to a cross-correlation score that exceeds the threshold yields information concerning the onset time of the transmitted voice test signal.

5. (Original) The method of claim 2, wherein the transmitted marker is in μ-law format, and the comparison of the markers includes converting the marker from μ-law to linear format.

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6.   (Original) The method of claim 1, wherein said providing provides a reference marker that includes a signal having a frequency that changes continuously with time.

7.   (Currently Amended) The method of claim 6, ~~wherein~~ said comparing and processing ~~being operated~~ are performed at a sampling frequency F, wherein said providing provides a reference marker that has N samples and that is a signal y given by:

$$y = \cos\left(2\pi\left(f_0 + \frac{(f1-f0)t}{T_1}\right)t\right)$$

where $f0$ = Onset frequency;

 $f1$ = Offset frequency;

 $T_1 = (N-1)/F$; and

 $t = t + 1/F$, and $0 \leq t \leq T_1$.

8.   (Currently Amended) The method of claim 1, wherein said transmitted marker ~~being~~ is divided into portions such that each portion thereof contains information concerning the onset, wherein each of at least some of said received packets contains one of the portions of the transmitted marker, and wherein said comparing compares the portion of the transmitted marker in each of the at least some of said received packets to the reference marker after such packet is received, so that information concerning onset time becomes available prior to receipt of packets containing the entire transmitted marker.

9.   (Original) The method of claim 1, wherein said providing provides a marker that is not more than 5 seconds in duration.

10.   (Original) The method of claim 1, further comprising transmitting packets containing the transmitted marker and transmitted voice test signal from a first device to a second device through the network, wherein the receiving and processing are associated with the second device.

11.   (Original) The method of claim 1, further comprising transmitting packets containing the transmitted marker and transmitted voice test signal from a first device to a second device through the network and transmitting such packets from the second device back to the first device, wherein the receiving and processing are associated with the first device.

12.   (Currently Amended) The method of claim 1, <u>wherein</u> said reference marker <u>is</u> divided into portions, said transmitted marker being also divided into portions such that the portions of the transmitted marker are received consecutively, wherein said comparing cross-correlates a current portion of the transmitted marker after it is received and before a next portion is received with each portion of the reference marker, and stores a score of the cross-correlation.

13.   (Currently Amended) The method of claim 12, <u>wherein</u> said comparing further ~~comprising~~ <u>comprises</u> comparing the scores from cross-correlation of the current portion with the different portions of the reference marker, selects a maximum score from such scores and compares the maximum score with a threshold.

14.   (Original) The method of claim 13, wherein said comparing cross-correlates the current portion with the different portions of the reference marker consecutively, compares the cross-correlation score obtained in each of such cross-correlations with a previously stored score, if any, and replaces the previously stored score, if any, with a current one if it is greater than the previously stored score.

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15.   (Original) A method for measuring voice quality of a communication network, comprising: providing a reference voice test signal;

receiving through the network packets containing a transmitted voice test signal through the network, said transmitted voice test signal being divided into portions, wherein each of at least some of said received packets contains one of the portions of the transmitted voice test signal; and

processing the transmitted voice test signal in the packets received and the reference voice test signal to measure quality of the network, and wherein said processing processes the portion of the transmitted voice test signal in each of the at least some of said received packets and the reference voice test signal after such packet is received, so that information concerning quality of the network becomes available after receipt of packet(s) containing said portion(s) and before receipt of packets containing all of the portions of the transmitted voice test signal.

16.   (Currently Amended) The method of claim 15, <u>wherein</u> said processing ~~including~~ <u>includes</u> normalizing the portion of the transmitted voice test signal in one of said received packets prior to receipt of at least one packet containing at least another portion of the transmitted voice test signal.

17.   (Original) The method of claim 16, further comprising:

providing a reference marker that indicates onset time of the reference voice test signal; and

receiving through the network packets containing a transmitted marker; wherein said processing including computing a normalization factor from the powers of the reference and transmitted markers and wherein said normalizing normalizes by means of the factor.

18.   (Original) The method of claim 16, wherein said normalizing computes a normalization factor using a weighted average of power of a previously received portion and power of currently received portion of the transmitted voice test signal.

19.   (Original) The method of claim 15, wherein information concerning quality of the network becomes available after receipt of at least one packet containing at least one portion of the transmitted voice test signal.

20.   (Original) The method of claim 15, further comprising transmitting packets containing the transmitted voice test signal from a first device to a second device through the network, wherein the receiving and processing are associated with the second device.

21.   (Original) The method of claim 15, further comprising transmitting packets containing the transmitted voice test signal from a first device to a second device through the network and transmitting such packets from the second device back to the first device, wherein the receiving and processing are associated with the first device.

22.   (Cancelled).

23.   (Cancelled)

24.   (Currently Amended) ~~The method of claim 22, further comprising~~ A method for
measuring voice quality of a communication network, comprising:

        causing a first VOPN device to communicate with a second VOPN device through the
network;

        transmitting data packets from the first VOPN device to the second VOPN device
through the network, said packets containing a voice test signal;

        receiving the transmitted packets through the network;

        processing the voice test signal in the transmitted packets received and a reference voice
test signal to measure quality of the network; and

        transmitting the packets transmitted from the first device and received by the second
device back to the first device, wherein the receiving and processing are associated with the first
device.

25.   (Currently Amended) ~~The method of claim 22, comprising~~ A method for
measuring voice quality of a communication network, comprising:

        causing a first VOPN device to communicate with a second VOPN device through the
network;

        transmitting data packets from the first VOPN device to the second VOPN device
through the network, said packets containing a voice test signal;

        receiving the transmitted packets through the network;

        processing the voice test signal in the transmitted packets received and a reference voice
test signal to measure quality of the network; and

        wherein said transmitting transmits packets containing a marker followed by the voice
test signal, said method further comprising comparing the transmitted marker or a portion thereof
with at least a portion of a reference marker to identify an onset time of the transmitted voice test
signal prior to the 20 processing.

26.   (Currently Amended) ~~The method of claim 22,~~ A method for measuring voice quality of a communication network, comprising:

causing a first VOPN device to communicate with a second VOPN device through the network;

transmitting data packets from the first VOPN device to the second VOPN device through the network, said packets containing a voice test signal;

receiving the transmitted packets through the network;

processing the voice test signal in the transmitted packets received and a reference voice test signal to measure quality of the network; and

wherein said processing makes use of the onset time of the transmitted voice test signal.

27.   (Cancelled).

28.   (Cancelled).

29.   (Currently Amended) ~~The device of claim 28,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network; and

wherein said processor ~~providing~~ provides a reference voice test signal and also a reference marker that indicates onset time of the reference voice test signal to the bus for transmission to another VOPN device.

30.   (Currently Amended) ~~The device of claim 29,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network; and

wherein said device ~~transmitting~~ transmits packets containing the reference marker and the reference voice test signal to another device through the network.

31.   (Currently Amended) ~~The device of claim 30,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network; and

wherein said processor compares the reference marker transmitted to and returned by another device and the reference marker and processes the reference voice test signal transmitted to and returned by another device with the reference voice test signal to measure the quality of the network.

32.   (Currently Amended) ~~The device of claim 28,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network; and

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network.

33.   (Currently Amended) ~~The device of claim 32,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network; and

wherein the comparison of the markers includes cross-correlating the markers to obtain a cross-correlation score and comparing the cross-correlation score with a threshold.

34. (Currently Amended) ~~The device of claim 33~~, A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network;

wherein the comparison of the markers includes cross-correlating the markers to obtain a cross-correlation score and comparing the cross-correlation score with a threshold; and

wherein a relative timing offset between onset times of the transmitted and reference markers corresponding to a cross-correlation score that exceeds the threshold yields information concerning the onset time of the transmitted voice test signal.

35.   (Currently Amended) ~~The device of claim 32,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network; and

wherein the transmitted marker is in μ-law format, and the comparison of the markers includes converting the transmitted marker from μ-law to linear format.

36.   (Currently Amended) ~~The device of claim 32,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network; and

wherein said transmitted marker ~~being~~ is divided into portions such that each portion thereof contains information concerning the onset time of 10 the transmitted voice test signal, wherein each of at least some of said received packets contains one of the portions of the transmitted marker, and wherein said processor compares the portion of the transmitted marker in each of the at -least some of said received packets to the reference marker after such packet is received, so that information concerning onset time becomes available prior to receipt of packets containing the entire transmitted marker.

37.   (Currently Amended) ~~The device of claim 32,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network; and

wherein said processor ~~comparing~~ compares a marker transmitted by another device with the reference marker and processes the reference voice test signal and a voice test signal transmitted from another device to measure the quality of the network.

38.   (Currently Amended) ~~The device of claim 32,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network; and

wherein said reference marker is divided into portions, wherein said transmitted marker ~~being~~ is also divided into portions such that the portions of the transmitted marker are received consecutively, and wherein said processor cross-correlates a current portion of the transmitted marker after it is received and before a next portion is received with each portion of the reference marker, and stores a score of the cross-correlation.

39.   (Currently Amended) ~~The device of claim 38,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network;

wherein said reference marker is divided into portions, wherein said transmitted marker is also divided into portions such that the portions of the transmitted marker are received consecutively, and wherein said processor cross-correlates a current portion of the transmitted marker after it is received and before a next portion is received with each portion of the reference marker, and stores a score of the cross-correlation; and

wherein said processor ~~comparing~~ compares the scores from cross-correlation of the current portion with the different portions of the reference marker, selects a maximum score from such scores and compares the maximum score with a threshold.

40.   (Currently Amended) ~~The device of claim 39,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network;

wherein said reference marker is divided into portions, wherein said transmitted marker being also divided into portions such that the portions of the transmitted marker are received consecutively, and wherein said processor cross-correlates a current portion of the transmitted marker after it is received and before a next portion is received with each portion of the reference marker, and stores a score of the cross-correlation;

wherein said processor compares the scores from cross-correlation of the current portion with the different portions of the reference marker, selects a maximum score from such scores and compares the maximum score with a threshold; and

wherein said processor cross-correlates the current portion with the different portions of the reference marker consecutively, compares the cross-correlation score obtained in each of such cross-correlations with a previously stored score, if any, and replaces the previously stored score, if any, with a current one if it is greater than the previously stored score.

41.   (Currently Amended) ~~The device of claim 32,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network; and

wherein said device ~~receiving~~ receives through the network packets containing the transmitted voice test signal, said transmitted voice test signal being divided into portions, wherein each of at least some of said received packets contains one of the portions of the transmitted voice test signal, and wherein said processor processes the portion of the transmitted voice test signal in each of the at least some of said received packets and the reference voice test signal after such packet is received, so that information concerning quality of the network becomes available after receipt of packet(s) containing said portion(s) and before receipt of packets containing all of the portions of the transmitted voice test signal.

42.   (Currently Amended) ~~The device of claim 41,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network;

wherein said device receives through the network packets containing the transmitted voice test signal, said transmitted voice test signal being divided into portions, wherein each of at least some of said received packets contains one of the portions of the transmitted voice test signal, and wherein said processor processes the portion of the transmitted voice test signal in each of the at least some of said received packets and the reference voice test signal after such packet is received, so that information concerning quality of the network becomes available after receipt of packet(s) containing said portion(s) and before receipt of packets containing all of the portions of the transmitted voice test signal; and

wherein said processor ~~normalizing~~ normalizes the portion of the transmitted voice test signal in one of said received packets prior to receipt of at least one packet containing at least another portion of the transmitted voice test signal.

43. (Currently Amended) ~~The device of claim 42,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network; wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network;

wherein said device receives through the network packets containing the transmitted voice test signal, said transmitted voice test signal being divided into portions, wherein each of at least some of said received packets contains one of the portions of the transmitted voice test signal, and wherein said processor processes the portion of the transmitted voice test signal in each of the at least some of said received packets and the reference voice test signal after such packet is received, so that information concerning quality of the network becomes available after receipt of packet(s) containing said portion(s) and before receipt of packets containing all of the portions of the transmitted voice test signal;

wherein said processor normalizes the portion of the transmitted voice test signal in one of said received packets prior to receipt of at least one packet containing at least another portion of the transmitted voice test signal; and

wherein the processor ~~providing~~ provides a reference marker indicating onset time of the reference voice test signal, wherein the device ~~receiving~~ receives through the network packets containing a transmitted marker, and wherein said processor computes a normalization factor from the powers of the reference and transmitted markers and wherein said normalizing normalizes by means of the factor.

44.   (Currently Amended) ~~The device of claim 42,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network;

wherein said device receives through the network packets containing the transmitted voice test signal, said transmitted voice test signal being divided into portions, wherein each of at least some of said received packets contains one of the portions of the transmitted voice test signal, and wherein said processor processes the portion of the transmitted voice test signal in each of the at least some of said received packets and the reference voice test signal after such packet is received, so that information concerning quality of the network becomes available after receipt of packet(s) containing said portion(s) and before receipt of packets containing all of the portions of the transmitted voice test signal;

wherein said processor normalizes the portion of the transmitted voice test signal in one of said received packets prior to receipt of at least one packet containing at least another portion of the transmitted voice test signal; and

wherein said processor computes a normalization factor using a weighted average of power of a previously received portion and power of currently received portion of the transmitted voice test signal.

45.   (Currently Amended) ~~The device of claim 41,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network;

wherein said device receives through the network packets containing the transmitted voice test signal, said transmitted voice test signal being divided into portions, wherein each of at least some of said received packets contains one of the portions of the transmitted voice test signal, and wherein said processor processes the portion of the transmitted voice test signal in each of the at least some of said received packets and the reference voice test signal after such packet is received, so that information concerning quality of the network becomes available after receipt of packet(s) containing said portion(s) and before receipt of packets containing all of the portions of the transmitted voice test signal; and

wherein information concerning quality of the network becomes available after receipt of at least one packet containing at least one portion of the transmitted voice test signal.

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46.   (Currently Amended) ~~The device of claim 28,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network; and

wherein said processor provides a reference marker that includes a signal having a frequency that changes continuously with time.

47.   (Currently Amended) ~~The device of claim 46,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network;

wherein said processor provides a reference marker that includes a signal having a frequency that changes continuously with time;

wherein said processor ~~operating~~ operates at a sampling frequency F, and

wherein said processor provides a reference marker that has N samples and that is a signal y given by:

$$y = \cos\left(2\pi\left(f_0 + \frac{(f1-f0)\,t}{T_1}\right)t\right)$$

where $f0$ = Onset frequency;

$f1$ = Offset frequency;

T_1 = (N-1)/F; and

t = t + 1/F, and $0 \le t \le T_1$.

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48.   (Currently Amended) ~~The device of claim 28,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network; and

wherein said processor provides a reference marker that is not more than 5 seconds in duration.

49.   (Currently Amended) ~~The device of claim 28,~~ A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data;

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network; and

wherein said CPU and bus are contained in a container with connectors connected to the module.

50.   (Cancelled).

51.   (Cancelled).

52.   (Cancelled).

53.   (Cancelled).

54.   (Cancelled).

55.   (Currently Amended) ~~The module of claim 54,~~ A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network; and

wherein said processor ~~providing~~ provides a reference voice test signal and also a reference marker that indicates onset time of the reference voice test signal to the bus for transmission to another VOPN device.

56.   (Currently Amended) ~~The module of claim 55,~~ A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network;

wherein said processor provides a reference voice test signal and also a reference marker that indicates onset time of the reference voice test signal to the bus for transmission to another VOPN device; and

wherein said device ~~transmitting~~ transmits packets containing the reference marker and the reference voice test signal to another device through the network, and wherein said processor compares the reference marker transmitted to and returned by another device with the reference marker and processes the reference voice test signal transmitted to and returned by another device with the reference voice test signal to measure the quality of the network.

57. (Currently Amended) ~~The module of claim 54,~~ A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network; and

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network.

58. (Currently Amended) ~~The module of claim 57,~~ A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network; and

wherein the comparison of the markers includes cross-correlating the markers to obtain a cross-correlation score and comparing the cross-correlation score with a threshold.

59. (Currently Amended) ~~The module of claim 58,~~ A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network;

wherein the comparison of the markers includes cross-correlating the markers to obtain a cross-correlation score and comparing the cross-correlation score with a threshold; and

wherein a relative timing offset between onset times of the transmitted and reference markers corresponding to a cross-correlation score that exceeds the threshold yields information concerning the onset time of the transmitted voice test signal.

60. (Currently Amended) ~~The module of claim 57,~~ A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network; and

wherein the transmitted marker is in μ-law format, and the comparison of the markers includes converting the transmitted marker from μ-law to linear format.

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61.   (Currently Amended) ~~The module of claim 57,~~ <u>A voice quality module for use
with a VOPN device for testing quality of a communication network through which data packets
containing voice signals are sent to and from the device, said device comprising a CPU and a bus
carrying voice data; said module comprising:</u>

<u>a processor that provides a reference voice test signal to the bus for transmission
to another VOPN device, or that processes a transmitted voice test signal received by the device
through the network with a reference voice test signal to test the quality of the network;</u>

<u>wherein said processor processes the reference and transmitted voice test signals, and
compares a transmitted marker received by the device through the network with a reference
marker to identify a timing offset between onset times of the reference and transmitted voice test
signals and processes the two voice test signals to measure the quality of the network; and</u>

<u>wherein</u> said transmitted marker ~~being~~ <u>is</u> divided into 15 portions such that each portion
thereof contains information concerning the onset time of the transmitted voice test signal,
wherein each of at least some of said received packets contains one of the portions of the
transmitted marker, and wherein said processor compares the portion of the transmitted marker in
each of the at least some of said received packets to the reference marker after such packet is
received, so that information concerning onset time becomes available prior to receipt of packets
containing the entire transmitted marker.

62.   (Currently Amended) ~~The module of claim 57,~~ A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network; and

wherein said processor ~~comparing~~ compares a marker transmitted by another device with the reference marker and processes the reference voice test signal and a voice test signal transmitted from another device to measure the quality of the network.

63.   (Currently Amended) ~~The module of claim 57,~~ <u>A voice quality module for use</u>
<u>with a VOPN device for testing quality of a communication network through which data packets</u>
<u>containing voice signals are sent to and from the device, said device comprising a CPU and a bus</u>
<u>carrying voice data; said module comprising:</u>

<u>a processor that provides a reference voice test signal to the bus for transmission</u>
<u>to another VOPN device, or that processes a transmitted voice test signal received by the device</u>
<u>through the network with a reference voice test signal to test the quality of the network;</u>

<u>wherein said processor processes the reference and transmitted voice test signals, and</u>
<u>compares a transmitted marker received by the device through the network with a reference</u>
<u>marker to identify a timing offset between onset times of the reference and transmitted voice test</u>
<u>signals and processes the two voice test signals to measure the quality of the network; and</u>

<u>wherein</u> said reference marker <u>is</u> divided into portions, <u>wherein</u> said transmitted marker
~~being~~ <u>is</u> also divided into portions such that the portions of the transmitted marker are received
consecutively, <u>and</u> wherein said processor cross-correlates a current portion of the transmitted
marker after it is received and before a next portion is received with each portion of the reference
marker, and stores a score of the cross-correlation.

64.   (Currently Amended) ~~The module of claim 63,~~ A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network;

wherein said reference marker is divided into portions, wherein said transmitted marker is also divided into portions such that the portions of the transmitted marker are received consecutively, and wherein said processor cross-correlates a current portion of the transmitted marker after it is received and before a next portion is received with each portion of the reference marker, and stores a score of the cross-correlation; and

wherein said processor ~~comparing~~ compares the scores from cross-correlation of the current portion with the different portions of the reference marker, selects a maximum score from such scores, and compares the maximum score with a threshold.

65. (Currently Amended) ~~The module of claim 64,~~ A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network;

wherein said reference marker is divided into portions, wherein said transmitted marker is also divided into portions such that the portions of the transmitted marker are received consecutively, and wherein said processor cross-correlates a current portion of the transmitted marker after it is received and before a next portion is received with each portion of the reference marker, and stores a score of the cross-correlation;

wherein said processor compares the scores from cross-correlation of the current portion with the different portions of the reference marker, selects a maximum score from such scores, and compares the maximum score with a threshold; and

wherein said processor cross-correlates the current portion with the different portions of the reference marker consecutively, compares the cross-correlation score obtained in each of such cross-correlations with a previously stored score, if any, and replaces the previously stored score, if any, with a current one if it is greater than the previously stored score.

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66.   (Currently Amended) ~~The module of claim 57,~~ A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network; and

wherein said device ~~receiving~~ receives through the network packets containing the transmitted voice test signal, said transmitted voice test signal being divided into portions, wherein each of at least some of said received packets contains one of the portions of the transmitted voice test signal, and wherein said processor processes the portion of the transmitted voice test signal in each of the at least 20 some of said received packets and the reference voice test signal after such packet is received, so that information concerning quality of the network becomes available after receipt of packet(s) containing said portion(s) and before receipt of packets containing all of the portions of the transmitted voice test signal.

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67.   (Currently Amended) ~~The module of claim 66,~~ A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network;

wherein said device receives through the network packets containing the transmitted voice test signal, said transmitted voice test signal being divided into portions, wherein each of at least some of said received packets contains one of the portions of the transmitted voice test signal, and wherein said processor processes the portion of the transmitted voice test signal in each of the at least 20 some of said received packets and the reference voice test signal after such packet is received, so that information concerning quality of the network becomes available after receipt of packet(s) containing said portion(s) and before receipt of packets containing all of the portions of the transmitted voice test signal; and

wherein said processor ~~normalizing~~ normalizes the portion of the transmitted voice test signal in one of said received packets prior to receipt of at least one packet containing at least another portion of the transmitted voice test signal.

68.   (Currently Amended) ~~The module of claim 67,~~ A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network;

wherein said device receives through the network packets containing the transmitted voice test signal, said transmitted voice test signal being divided into portions, wherein each of at least some of said received packets contains one of the portions of the transmitted voice test signal, and wherein said processor processes the portion of the transmitted voice test signal in each of the at least 20 some of said received packets and the reference voice test signal after such packet is received, so that information concerning quality of the network becomes available after receipt of packet(s) containing said portion(s) and before receipt of packets containing all of the portions of the transmitted voice test signal;

said processor normalizing the portion of the transmitted voice test signal in one of said received packets prior to receipt of at least one packet containing at least another portion of the transmitted voice test signal; and

wherein the processor ~~providing~~ provides a reference marker indicating onset time of the reference voice test signal, the device receiving through the network packets containing a transmitted marker, wherein said processor computes a normalization factor from the powers of the reference and transmitted markers and wherein said normalizing normalizes by means of the factor.

69. (Currently Amended) ~~The module of claim 67,~~ A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network;

wherein said device receives through the network packets containing the transmitted voice test signal, said transmitted voice test signal being divided into portions, wherein each of at least some of said received packets contains one of the portions of the transmitted voice test signal, and wherein said processor processes the portion of the transmitted voice test signal in each of the at least 20 some of said received packets and the reference voice test signal after such packet is received, so that information concerning quality of the network becomes available after receipt of packet(s) containing said portion(s) and before receipt of packets containing all of the portions of the transmitted voice test signal;

said processor normalizing the portion of the transmitted voice test signal in one of said received packets prior to receipt of at least one packet containing at least another portion of the transmitted voice test signal; and

wherein said processor computes a normalization factor using a weighted average of power of a previously received portion and power of currently received portion of the transmitted voice test signal.

70.   (Currently Amended) The module of claim 66, A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network;

wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network;

wherein said device receives through the network packets containing the transmitted voice test signal, said transmitted voice test signal being divided into portions, wherein each of at least some of said received packets contains one of the portions of the transmitted voice test signal, and wherein said processor processes the portion of the transmitted voice test signal in each of the at least 20 some of said received packets and the reference voice test signal after such packet is received, so that information concerning quality of the network becomes available after receipt of packet(s) containing said portion(s) and before receipt of packets containing all of the portions of the transmitted voice test signal; and

wherein information concerning quality of the network becomes available after receipt of at least one packet containing at least one portion of the transmitted voice test signal.

71.   (Currently Amended) ~~The module of claim 54,~~ <u>A voice quality module for use</u> <u>with a VOPN device for testing quality of a communication network through which data packets</u> <u>containing voice signals are sent to and from the device, said device comprising a CPU and a bus</u> <u>carrying voice data; said module comprising:</u>

<u>a processor that provides a reference voice test signal to the bus for transmission</u> <u>to another VOPN device, or that processes a transmitted voice test signal received by the device</u> <u>through the network with a reference voice test signal to test the quality of the network; and</u>

wherein said processor provides a reference marker that includes a signal having a frequency that changes continuously with time.

72.   (Currently Amended) ~~The module of claim 71,~~ <u>A voice quality module for use</u> <u>with a VOPN device for testing quality of a communication network through which data packets</u> <u>containing voice signals are sent to and from the device, said device comprising a CPU and a bus</u> <u>carrying voice data; said module comprising:</u>

<u>a processor that provides a reference voice test signal to the bus for transmission</u> <u>to another VOPN device, or that processes a transmitted voice test signal received by the device</u> <u>through the network with a reference voice test signal to test the quality of the network;</u>

<u>wherein said processor provides a reference marker that includes a signal having a</u> <u>frequency that changes continuously with time; and</u>

<u>wherein</u> said processor ~~operating~~ <u>operates</u> at a sampling frequency F, wherein said processor provides a reference marker that has N samples and that is a signal y given by:

$$y = \cos\left(2\pi\left(f_0 + \frac{(f1-f0)\,t}{T_1}\right)t\right)$$

where $f0$ = Onset frequency;

$f1$ = Offset frequency;

T_1 = (N-1)/F; and

t = t + 1/F, and $0 \le t \le T_1$.

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73.   (Currently Amended) ~~The module of claim 54,~~ A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network; and

wherein said processor provides a reference marker that is not more than 5 seconds in duration.

74.   (Cancelled).

75.   (Cancelled).

76.   (Cancelled).

77.   (Original) A method for measuring voice quality of a communication network comprising:

providing a reference marker that indicates onset time of a reference voice test signal, and the reference voice test signal; and

transmitting to a device through the network packets containing the reference marker and a reference voice test signal through the network.

78.   (Original) A method for measuring voice quality of a communication network, comprising:

providing a reference marker that indicates onset time of a reference voice test signal, and the reference voice test signal; and

receiving through the network packets containing a transmitted marker and a transmitted voice test signal through the network.

79.   (Original) The method of claim 78, further comprising comparing the transmitted marker with the reference marker, or portions thereof, to ascertain onset time of the transmitted voice test signal in the packets received.

80.   (Original) The method of claim 79, further comprising processing the transmitted voice test signal and the reference voice test signal to measure quality of the network.